Introduction

The Air Force currently participates in two major technology transfer award calls for nominations; the General Ronald W. Yates Award for Excellence in Technology Transfer, an Air Force Materiel Command (AFMC) sponsored award, and the Federal Laboratories Consortium (FLC) sponsored award. General Yates was the first commander of AFMC and a champion of technology transfer.

Two presentations are made for this award, one to an individual and one to a team. The FLC honors its technology transfer professionals through an award program in the following categories: (1) FLC Awards for Excellence in Technology Transfer, (2) FLC Service Awards, and (3) Laboratory Director of the Year Awards. The cycle for calls for nominations for both of these awards is usually mid-summer with nominations due to AFRL/HR and FLC early in the fall for presentation the following spring.

General Ronald W. Yates Award for Excellence in Technology Transfer

This award honors General Yates' numerous and lasting contributions to the Air Force Science and Technology program. Established upon his retirement as the first commander of the Air Force Materiel Command, the award is a lasting tribute to his achievements and to his support to technology transfer. Significant achievements of individuals and teams assigned to AFMC organizations are recognized for their contribution to move technology from AFMC to the public and private sector. This award consists of a trophy for permanent display in the Headquarters Air Force Research Laboratory award case. Each award recipient receives a plaque for permanent retention and a letter of commendation. All nominees receive certificates recognizing their contribution to the AFMC technology transfer program. Attachments Q1, Q2 and Q3 are write-ups for FY99 and FY00 winners.

Efforts are currently underway to provide the opportunity to give cash awards to both military and civilian award winners. Eligibility, previous winners and other details on this award are available at www.afrl.af.mil/techtrans/index.htm. Process draft OI (Atch Q4), flowchart (*Figure Q1*), format and scoring criteria (Atch Q5), and the citation format (Atch Q6), and FLC Award nomination packages are at Attachments Q7 and Q8 respectively. Direct questions regarding eligibility, format, scoring and citation to AFRL/HR, 937-656-9796.

Federal Laboratory Consortium (FLC) for Technology Transfer Excellence Awards

The FLC awards recognize federal laboratory employees who have accomplished outstanding work in the process of transferring a technology developed by a federal laboratory. Nominations are made by FLC laboratory members and are judged by representatives from industry, state and local government, academia and federal laboratories. Nomination itself is a significant honor. AFRL is highly competitive for these awards, winning at least one award per year for the past three years. The FLC presents a maximum of 30 awards annually. The general criteria include: (1) an individual or team of individuals has demonstrated uncommon creativity and initiative in the transfer of technology, (2) the benefits to industry, state and local government, and/or the general public are significant, and (3) the achievements are recent. Attachments Q8 and Q9 are the winning nominations submitted by the Air Force for CY2000.

Further information on the FLC awards and previous winners is available on: www.federallabs.org.

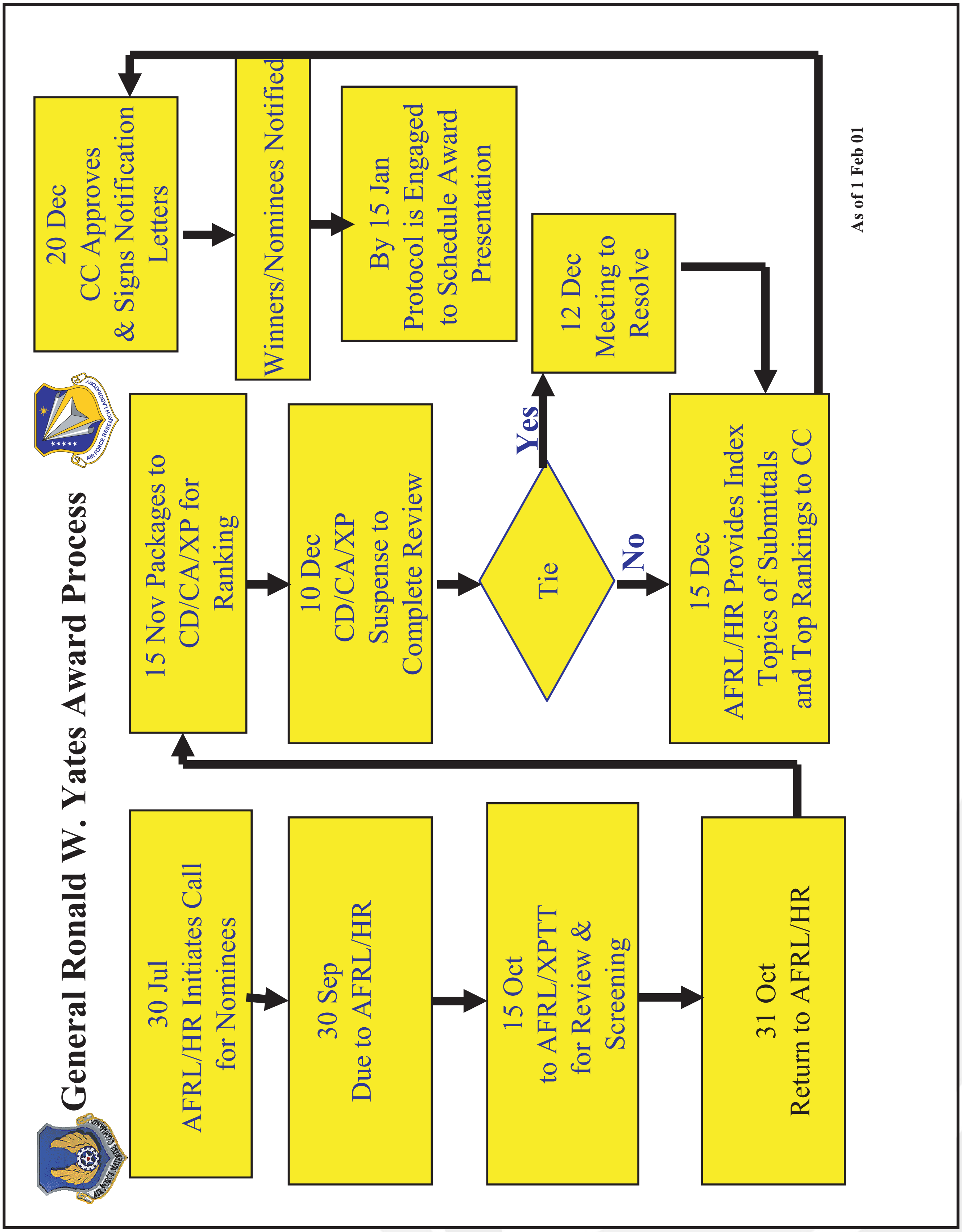
General Ronald W. Yates Award Process
30 Jul
AFRL/HR Initiates Call for Nominees
30 Sep
Due to AFRL/HR
15 Oct
to AFRL/XPTT for Review & Screening
31 Oct
Return to AFRL/HR
15 Nov Packages to CD/CA/XP for Ranking
10 Dec
CD/CA/XP Suspense to Complete Review
Tie
Yes
No
12 Dec
Meeting to Resolve
15 Dec
AFRL/HR Provides Index Topics of Submittals and Top Rankings to CC
20 Dec
CC Approves & Signs Notification Letters
Winners/Nominees Notified
By 15 Jan
Protocol is Engaged to Schedule Award Presentation
As of 1 Feb 01

Figure Q1

GENERAL RONALD W. YATES
TECHNOLOGY TRANSFER AWARD NOMINATION

NOMINEE: Sandra Fries-Carr

OCCUPATIONAL SERIES/AFSC: 0850

GRADE/RANK: DR-II

TITLE: Electrical Engineer

OFFICE SYMBOL: AFRL/PRPE

JUSTIFICATION:
A Practical Commercial or Public Advancement Made by the Efforts of the Nominee:

The Air Force needs high temperature capacitors that have superior electrical properties above what is offered in today's market place. Today's capacitor devices are only rated for operation up to 125 C. Failures caused by overheating dramatically underscore the need for higher temperature capacitors. Capacitors for future weapon systems that employ more electric technologies will operate at elevated temperatures that will surely cause premature failures. With this knowledge, a program to develop high temperature film for use in capacitors was initiated and directed by Ms. Sandra Fries-Carr. The goal of this program was to demonstrate a high temperature capacitor film for maximum operating temperature of 225 C. The film chosen for development under this program was called FPE (Fluoro Poly Esther). The FPE film was a 3M proprietary experimental film and the AF program essentially developed it into a quality capacitor grade film and focused on the production processing for use in military capacitors. Several capacitors were developed and successfully tested under the program up to 225 C. The program was quite successful and the Air Force has an intense need for these devices. 3M at that time was not willing to manufacture the film. In 1996, Imation was created by the spin-off of 3M's imaging and information businesses. Imation then sold off a portion of their business to Ferrania, Inc., which included FPE. The facilities of Ferrania, Inc. are the same facilities that FPE was originally developed in, under the AF contract. This commercial availability of FPE film will start in October 1999, with the film actually sold on the market. However, the development of this superior film or its entrance into the market scene would not have happened without the perseverance and dedication of Ms. Sandra Fries-Carr. The commercial sector will not develop advanced films on their own as long as the current polymers satisfy the big market customers (i.e. cellular communication, computers, etc).

B. Technology Transfer Effort by the Nominee(s) Beyond Normal Job Scope:

This commercialization effort stems from a technology identification procedure called 'Tiger Team' within the Propulsion Directorate, which assessed twenty-two candidate technologies for commercial readiness. Three of which were funded for commercialization activities through Wright Technology Network (WTN), one of course being the FPE film. Wright Technology Network is a not-for-profit Ohio corporation established to facilitate the effective transfer and profitable commercialization of technology from federal laboratories and academic institutions to industry in the Great Lakes region. The objective of this particular commercialization project is to make capacitors with enhanced capabilities available for procurement for AF and DOD systems. WTN provides cohesion to this project and represents the Air Force's interest as business relationships were developed. To assist with the transfer, Sandra was to provide the following on a continuing basis as needed by WTN:

- Evaluate the return on the technology investment to the Air Force,
- Determine what support effort the AF will provide in terms of reports, time with scientist, access to facilities,
- Define products which this technology could impact,
- Identify customers who would benefit from the new product,
- Find the resources needed for a successful product launch,
- Identify target industries that would manufacture the new product,
- Identify companies which are capable of developing the product,
- Develop a communication program to inform the target companies/market of the technology offering,
- Evaluate interested prospects' business plans in this product area to see how the technology and product fit their needs,
- Develop agreements with the company and the AF, and follow up to keep the project on schedule.

Some of the main obstacles encountered by Sandra in transferring the technology to industry were the following:

- Persuading the potential film developers and capacitor fabricators that there was a high temperature market that existed in the commercial sector for capacitors,
- Identifying companies that had the ability to handle the processing of FPE, both chemically and thermally (they are far and few between!),
- Once locating a company that can handle the processing of FPE, determine if they are financially a good candidate to take it on or if they even have the interest/desire to do so,
- Working through competition and confidentiality agreements between resin producers, film casters, metallizors/slitters and then capacitor houses, and
- Finding other commercial products for FPE to ensure competitive prices for FPE capacitors in comparison to SOTA commercial capacitors.

These challenges were overcome by Sandra’s sheer determination that she had a good product and that if she could pull together the right combination of industries, she could deliver and transfer the best polymer the world has ever seen to-date. Over the last couple of years, in depth interactions between many companies in different countries concerning one or more areas in the development of the resin, film or fabrication have taken place. She pursued (through numerous telephone calls, letters, e-mails, fax, visits, etc.) Isovolta and Isonova in Austria, DuPont, Daychem, Inc., Ferrania, Inc. in Italy, and TPL, Inc., for the development of the FPE monomer. She pursued 3M, Imation, ECI, Dearborn Capacitors, Maxwell Laboratories, Brady, Inc., Rexham, and others for the fabrication of the film. She pursued ECI, Dearborn Capacitors, Maxwell Laboratories, and Aerovox for the fabrication of capacitors. She has talked to many industries concerning potential markets for FPE including: Maxwell Labs, BF Goodrich Aerospace, Leland Company, Northrop Grumman, Parker Hannifin, National Automotive Center, Allied-Signal Aerospace Company, Sundstrand, Component Research Company, and DELCO Electronics, to name a few. On 19 Mar 90, 3M filed for a patent covering the use of high purity FPE in capacitors and other products. That patent was issued as US 4,967,306 on 30 Oct 90 and a CIP on 19 May 92 as US 5,115,372.

C. The Degree and Significance of Tangible Benefits to Industry or State/Local Governments:

The primary market area for the FPE produced by Ferrania, for the military, will be for film capacitors. Current high energy density polymer film capacitors produced from polyester or polypropylene are limited in usage temperature to around 125 C. Whereas, the FPE will enable 250 C usage with greater voltage breakdown strength over current SOTA. The entrance of FPE into the market place will nearly revolutionize many systems heavily dependent on high performance capacitors. The world market for capacitor film was valued at approximately $700M annually in 1995 with a total market for film capacitors valued at over $2.5B for this same time period. The film market is almost entirely captive, indicating that strategic partnership is the best route to commercialization. This has been achieved through the cooperation of Ferrania, Brady, Inc., TPL, Inc, and many of the high performance capacitor fabricators such as Maxwell Laboratories, and Aerovox. The recipient of this technology transfer will be the entire electronic world, as there are no dielectric films on the market today that can compete with the superior performance of FPE. As a result of our pursuit for a fabricator/distributor of FPE, we discovered that FPE could be considered for other markets. These markets include aircraft coatings, liquid crystal displays, flexible circuit boards, small surface mount capacitor devices, a Kapton replacement in wire insulation and as a photosensitive material in medical imaging equipment. The potential of this dielectric is far-reaching into many significant applications worldwide.

21 Sep 00

Nomination for Gen. Ronald Yates Technology Transfer Award

Nominee: Dr. Bruce Suter

Occupation Series/AFSC: Electronic Engineer/ GS-855 with Lab Demo

Grade: DR III

Title: Principal Research Engineer for Signal Processing

Office Symbol: AFRL/IFGC, 525 Brooks Rd, Rome NY, 13441-4551

Nomination of Dr. Bruce Suter for Gen. Ronald Yates Technology Transfer Award

A. Practical Commercial or Public Advancement Made by the Efforts of the Nominee

1. **Description of Technology** – Dr. Suter invented an architecture for a new, high performance Fast Fourier Transform (FFT), a design with a speed processing capability up to an order of magnitude faster than present products. The multirate features of this FFT architecture permit an input data sequence to be broken down into its polyphase components. These polyphase components can then be operated upon in a local and parallel manner. Localizing and minimizing loads of the circuit allows operations to be performed only when necessary in an asynchronous manner. The energy consumed in his N-point FFT is significantly less than that of present day FFT's employing global memory and clock methodologies, at least two to four times less power required than the state of art research FFT(SPIFFEE) recently developed at Stanford . The feature of low energy consumption makes Suter's invention attractive to hand-held audio/video devices, where energy requirements can be met with a low rate of battery replacement.

2. **Tech Transfer Recipient and Need for Technology** – Numerous new military and commercial applications and enhanced capabilities are possible with the new generation of high speed, low power FFT processors as exemplified by this Suter-Stevens FFT.

   For example, this FFT could greatly increase the capabilities of modern signal processing for communications and radar, since it would make practical the notion of a *staring* receiver (vis-à-vis a *sweeping* receiver) – a receiver with 100% probability of detection. In the case of a frequency hopping system, 100% of the hopped energy can be captured and processed. In this case, it is possible to create a complete time sequence of the hopper and extract the data at each frequency in the hop sequence. This is possible as the receiver could have an instantaneous bandwidth of one GHz and sees the entire spectrum at once. The FFT process breaks the spectrum into smaller slices where threshold logic can detect the change in any frequency bin. This bin is then sent to the processor for evaluation. As this receiver is not scanning it will view and be able to capture every frequency bin to where the hopper transcends.

This is not the case in a conventional swept receiver which, by virtue of the short dwell time on any particular frequency, may capture less than 1/1000 of the frequencies in a hop sequence. This occurs as a swept receiver can only be tuned to one frequency at a time. If it is swept too fast, low energy signals are not detected at all, while if it is too slow, the probability of being at the right frequency at the right time is very low. This same philosophy can also be applied to Radars and other emitters being monitored.

3. **Technology or Technical Expertise** – Dr. Suter invented an architecture for a high performance FFT signal processor that provides significant technical performance improvements above and beyond present and next generation designs.

4. **Initiation of Technology** – Dr. Suter developed the initial ideas for this technology when he was a faculty member at the Air Force Institute of Technology in the 1996-1997 timeframe.

B. The Technology Transfer Effort by Nominee Beyond Normal Job Scope

1. **Tech Transfer Partnership** – The primary participants to date have been the Air Force Research Laboratory and Intel Corporation. More recently, other commercial vendors and agencies have expressed appreciable enthusiasm; included are MIT Lincoln Laboratory, who has provided free fabrication runs, and Los Alamos National Laboratory, who has offered to perform a system level evaluation using the Suter-Stevens FFT processor. In addition, Honeywell Inc. is very interested in using this technology as a core Digital Signal Processor (DSP) option for its Computer Aided Design (CAD) tools.

2. **Tech Transfer Processes Used/Innovations** – The patent was granted for the FFT and it was used as a vehicle to transfer Suter's ideas to the industrial design process. In addition, Los Alamos National Laboratory, Honeywell Inc., and MIT Lincoln Laboratory have expressed strong interest in licensing the technology once integrated circuit chip design and evaluation cycles are completed..

3. **Constraints** – The major challenge in transferring this technology was due to the fact that this FFT processor is based on a revolutionary new VLSI design concept that permits tradeoffs between the number of transistors used, their power dissipation, and, if applicable, their radiation hardness. This design paradigm goes contrary to conventional wisdom. Nonetheless, the projected and measured performances to date have been quite remarkable and are the best advertisers of the potential performance advantages of this FFT design.

4. **Time Frame** -- The time frame can be broken into three parts since this FFT design can be optimized for at least three principal functions. Presently these functional developments are at different levels of maturity. They are (1) a radiation hardened FFT whose target is future Air Force satellite systems, such as Space-Based Radar (2005), Space-Based Laser (2010), and Space-Based Imaging Satellites [SBIRS-Low (2006), Advanced EHF (2007), Advanced SBIRS (2007)]; (2) an earth-bound FFT for both military and commercial applications; and (3) a very large point size earthbound FFT for mobile signal intelligence applications. The design of an optimized 256 point radiation hardened FFT is scheduled to be completed by the end of CY00. The design of an optimized 1024 point earth-bound FFT is scheduled to be completed by April 01. A

preliminary study concerning the design issues related to a 16,384 point FFT processor are planned to be studied during CY01.

5. **Technology Transfer Efforts Above and Beyond Call of Duty** – Since the inventor's expertise is in signal processing, becoming aware of the issues of asynchronous circuit design was the biggest technical challenge. Another major challenge of this technology transfer was the marketing of this new technology – an endeavor that is rather strange to a research-oriented engineer. Extensive collaborations with other AF potential users, commercial manufacturers, and the engineering staff of Intel were key ingredients that are accelerating this technology transfer.

6. **Patents and Publications**

   [1] B. W. Suter and K. S. Stevens, **Low Power, High Performance Fast Fourier Transform Processor**, patent issued November 3, 1998 with patent number 5831883. (Patent based on tradeoffs between number of transistors used and power dissipation of the chip.)

   [2] D. Barnhart, P. Duggan, B. Suter, C. Brothers, and K. Stevens, *Total Ionizing Dose Characterization of a Commercially Fabricated Asynchronous FFT for Space Applications,* **Hardened Electronics and Radiation Technology Conference**, March 2000, Anaheim, California. (Electrical and radiation tests for fabricated FFT chip)

   [3] B. W. Suter, **Multirate and Wavelet Signal Processing**, San Diego, California: Academic Press, 1998. (Recently published book, which places this work in the context of multirate and wavelet signal processing – over a thousand books sold to date)

7. **Final Results** – The development of the hardware and software processes to build this FFT has become a priority project for the new ASIC organization within the Microprocessor Design Division of Intel. The Intel chip designers are being assigned fulltime to this project and Intel plans to introduce this FFT processor as a new product for the company.

C. The Degree and Significance of Tangible Benefits to Industry or State/Local Governments

1. **Recipients/Technology Users –** The significance of this device to the signal processing world is comparable to Cooley and Tukey's paper on the FFT. By its very existence, new applications will open up. New applications that result from the availability of this FFT processor include: (a) low power approach to do transform-based interference mitigation for the cell phone industry and (b) new ways to effectively increase the density of computer disk drives by using the FFT processor to provide very precise phase and amplitude corrections to signals as a function of frequency.

2. **Tangible Benefits and Their Significance** – Intel Corp. plans to introduce this FFT processor as a new product for their company. Expect a large military application to satisfy next generation communications and radar operational objectives for improved bandwidth utilization and target identification. The demand for wireless voice and internet connectivity, whether for military or commercial purposes, will be greatly enhanced by the high performance and low power consumption features of this product.

3. **New Relationships** – Several industrial firms and national laboratories, including Honeywell Inc. and Los Alamos National Laboratory have expressed interest in licensing this new technology.

4. **Leveraging** – Discussions are in progress with DARPA concerning a very large, very low power FFT with potential application to Army mobile communications problems.

GENERAL RONALD W. YATES TECHNOLOGY TRANSFER AWARD NOMINATION

CARBON-FIBER COMPOSITE, FOREARM CRUTCH
TECHNOLOGY TRANSFER TEAM

Dr. Vernon T. Bechel

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DR-II
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Description of Technology

The technologies transferred involved the application of the appropriate carbon-fiber composite material, the physical capabilities of this material, the means of fabricating the materials, structural/computational analysis capabilities, and the ability to design, manufacture and test a prototype composite structure. The in-depth knowledge of surface preparation and application of joint bonding technology developed for the assembly of airframes and other aerospace applications was also critical to the project.

The Air Force designed a composite crutch with the major structural members composed of lightweight carbon fiber composite. Critical noisy, wear-prone mechanical joints were replaced with silent, ultra-high strength adhesive joints. A computer model was used to reduce the weight and volume of material required. Laboratory mechanical testing of prototypes was followed up with non-destructive evaluation of prototypes used over a 9-month period by 2 volunteer lifetime crutch users. The final product is a forearm crutch that when compared to a typical aluminum crutch on the market is 60% lighter, 20% stronger (to meet the needs of a wider x-section of users), virtually silent in use, and is expected to last much longer than aluminum crutches.

Tech Transfer Recipient and Need for Technology

The recipient of the technology was Ergonomics, Inc., a Dayton, OH retail seller of ambulatory crutches, canes and walkers who has begun initial production of the composite forearm crutches. During the past several years, Ergonomics, Inc., received numerous complaints from long-term users of aluminum forearm-crutches that forearm crutches were too heavy. These complaints led Ergonomics to look for an alternative forearm crutch, made from lightweight composite materials. Unfortunately, the company lacked the technical expertise to design a composite device.

ML's knowledge of and capabilities for working with composites were the items transferred, as well as a complete set of instructions for manufacture of the crutch. The Materials and Manufacturing Directorate provided the needed knowledge and design assistance and in return, earns royalty payments on product sales.

The new composite crutch addresses several issues that handicapped crutch users face each day. Crutch users indicate that the act of lifting the metal crutches on each step taken can limit the user's mobility due to fatigue. Heavy crutches have been known to contribute to chronic shoulder joint problems. The pin adjustments in current metal crutches become noisy and wear out within 2 years for typical users and in less than a year for more active crutch users requiring the purchase of a new pair relatively often at a cost of $60 to $100 per pair.

Technology or Technical Expertise

The nominees drew on their years of experience in structural design, computational modeling of composites, mechanical strength testing, and application of adhesive joint concepts to design, engineer, fabricate, and test several working prototypes of the composite crutch. The recipient of this technology had no expertise in the system's technology areas.

Initiation of Technology

Ergonomics brought the concerns of crutch users to the Wright Technology Network (WTN) who, in turn, recognized that the crutch problems might be addressed with materials technology. WTN brought the problem to the attention of engineers in the Structural Materials Branch at AFRL/MLBC.

An improved crutch design required the application of next generations materials as well as the experience to efficiently and appropriately blend the use of these materials with the standard materials found in a variety of cuffs, handgrips, and crutch tips that needed to be compatible with the composite structural parts. The design of composite structures is computationally intensive and requires significant knowledge in the areas of material properties, fatigue, and fracture mechanics. Federal labs are involved in composite materials research including concept development, design, testing, and non-destructive evaluation. An otherwise technically inexperienced company could significantly benefit from these areas of expertise.

Tech Transfer Partnership

As stated above, Ergonomics brought the concerns of crutch users to the Wright Technology Network (WTN) who, in turn, recognized that the crutch problems might be addressed with materials technology. WTN brought the problem to the attention of engineers in the Structural Materials Branch at AFRL who realized that composite materials and advanced design methodologies such as finite element modeling could be used to significantly improve upon current crutch design.

The goals of the partnership were: 1) To make a crutch significantly lighter than typical crutches on the market while, 2) Maintaining strength equal to typical crutches on the market, 3) Reduce noise and increase life expectancy of the crutches, and 4) Improve crutch appearance.

These goals were developed from the input of experienced crutch users and the various quality of life issues identified by Ergonomics. The engineers then worked closely with a crutch user from Ergonomics as well as another who is an employee of the Air Force at McClellan AFB to determine which issues should receive priority and which of the Air Force's proposed solutions were ergonomically appropriate.

All goals were met or exceeded. The final product is 60% lighter, 20% stronger, nearly silent in use, is lacking several of the previous sources of wear and failure, and has a much better appearance as expressed by our prototype users.

Tech Transfer Processes Used/Innovations

WTN brought the skills of Air Force material scientists together with Ergonomics. This resulted in a Cooperative Research and Development Agreement being negotiated and signed in support of this research effort. The CRADA included a provision for royalty payments based on future crutch sales. This was possible because the Structural Materials Branch supports activities that include technology transfer for public interest.

Constraints

From the consultations it was apparent that crutches are often used in many unexpected ways. They may be submerged while entering a swimming pool, for example. They may be used as a pry bar to facilitate exiting a car. Crutches often fall over, are accidentally stepped on, and are banged against hard objects. They may be used to walk through mud pulling the foot off if not properly attached. They endure considerable shock when walking down steps. A user may stop and need to make hand gestures while placing most of his/her weight on the cuff rather than the handle. A substantial factor of safety had to be included in the design to address all of these uses/abuses.

Time Frame

The CRADA was signed 30 Dec 94 and completed 30 Dec 99. The final report for the Composite Forearm Crutch CRADA between AFRL and Ergonomics was completed 7 Apr 00.

Technology Transfer Above and Beyond the Call of Duty

All aspects of this technology transfer were within the regular job duties of the nominees. The design, fabrication, and testing work were done concurrently while conducting research projects for Air Force technology interests.

Patents and Publications (3 points)

Patents: There were no new patents associated with this CRADA work. A patent disclosure is in place for the adhesively bonded structure of the crutch.

Publications: WTN Innovator, May/June 2000; Dayton Daily News, March 2000; Local Channels 2 and 7 Nightly News; Air Force Radio News, spring 2000; WSWM Talk Radio; WMUB Public Radio Oxford; AFRL Technology Horizons, fall 2000; Federal Technology Report, summer 2000

Final Results: The CRADA effort resulted in the successful design of the world's first carbon-fiber composite, forearm crutch. The team designed, tested, and produced the prototype, including design and manufacturing specifications. The CRADA partner, Ergonomics Inc., plans to produce and market the crutch directly over the Internet. The AFRL Materials and Manufacturing Directorate will receive a royalty base on gross sales. This crutch will greatly improve the day-to-day activities of crutch users. The ML nominees are continuing to monitor

(inspect and analyze) the two sets of developmental crutches. Quotes from our prototype testers Mrs. Joyce Young, and Mr. Jim Barone:
"solid as a rock and light as a feather"
"first major advance in forearm crutch technology in 40 years"
"My wife is worried that they (AFRL) will need them back before my daughter's wedding."
"My secretaries call them the stealth crutches because they can't here me coming."
"I'm just delighted. They are everything I could have hoped for."

Recipients/Technology Users

The initial beneficiaries of the composite crutch will be long-term users of forearm crutches. In time, the crutch should become available to those using crutches for short-term recovery as well. The benefits are both in life-style and function. The composite crutches are lighter (less-effort for the user during a normal day), stronger (more safety), much less noisy in operation, longer-lived, and more stylish in appearance. The population of long-term crutch users (>10000) in the USA alone is large. The use of forearm crutches outside the USA is much more common since they are typically used for short-term use as in healing of leg fractures as well as lifetime use as in victims of polio and various debilitating diseases.

Tangible Benefits and Their Significance

First a new lightweight composite crutch (60% lighter) was developed that is expected to improve the quality of life for thousands of handicapped people by improving their mobility, safety (20% stronger), and reducing the stigma of using the older "clanking," metallic-hospital appearing crutches. Thus, hardware was developed that is currently improving the lives of lifetime crutch users local to Dayton and potentially will affect handicapped people nationally. Ergonomics has 30 orders for these crutches in hand from word of mouth alone (no advertising yet) and manufacture and advertising is in place expects the level of demand to dramatically increase. Since quality of life is difficult to put numbers to it seems appropriate to repeat the actual quotes that have come back from the users of these crutches:
"The crutches are great. I am still not accustomed to their light weight."
"They look so good – sleek and clean"
"solid as a rock and light as a feather"
"first major advance in forearm crutch technology in 40 years"
"My wife is worried that they (AFRL) will need them back before my daughter's wedding."
"My secretaries call them the stealth crutches because they can't here me coming."
"I'm just delighted. They are everything I could have hoped for."

New Relationships

This successful technology has opened up several new relationships in the composites manufacturing community. In the process of designing tubes that are economically fabricated, AFRL worked closely CODA composites of Wynona, MN. CODA composites will likely be a subcontractor to Ergonomics in the manufacture of these forearm crutches. The National Composites Center in Kettering, Ohio has also offered to look at manufacturing methods for the structural parts.

Leveraging

The approach of using graphite fiber composites for lightweight and strength as well as reducing mechanical joints through aerospace grade adhesives and bonding technology may also be applied to walkers for the physically impaired and leg braces for the handicapped. The concept has been proven on the composite forearm crutch making it easier to apply this technology to other handicapped aids in the future.

NOTICE: This publication is available digitally on the HQ AFMC WWW site at: http://afmc.wpafb.af.mil. If you lack access, contact your Publishing Distribution Office (PDO).

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Supersedes AFMCI 36-2811, 20 Nov 95

Certified by: HQ AFRL/XPTT
(Mr. Douglas E. Blair)
Pages: 5
Distribution: F

This instruction implements AFPD 36-28, Awards and Decorations. It explains eligibility requirements, selection criteria, and nomination procedures for the General Ronald W. Yates Award for Excellence in Technology Transfer.

1. Policy. This awards program is administered by AFRL/HR and applies to all AFMC organizations engaged in the transfer of technology to other government agencies, industry, academia and the private sector.

1. Background of the Award. The General Ronald W. Yates Award for Excellence in Technology Transfer, honors Gen Yates' numerous and lasting contributions to the Air Force Science and Technology program. This award was established upon his departure from active duty as the first Commander of Air Force Materiel Command and as a lasting tribute to his achievements and support of technology transfer.

1.2 Purpose of the Award. The purpose is to recognize a significant achievement of individuals and teams assigned to AFMC organizations in the movement of technology between AFMC and the public and/or private sector.

1.3 Description of the Award. The award will consist of a trophy for permanent display to be showcased in the HQ AFRL's awards case. In addition, each award recipient will receive a plaque for permanent retention and a letter of commendation. All nominees will receive certificates recognizing their contribution to the AFMC Technology Transfer Program.

2. Period. The period for this award is from 1 January through December 31 of the previous calendar year.

3. Eligibility. The nominee(s) must be a US Government civilian or military member of either the Air Force Research Laboratory (AFRL) or of an Air Force Materiel Command center, or some combination of the two. Individual and team nominations will be considered. The nominee(s) should be mid-level members of the organization (typically, pay band II (GS-12/13) or senior captain/major) with direct involvement or responsibility for the transfer of a laboratory technology effort, process, or system/subsystem to a customer. Contractor personnel contributing to the success of the technology transfer may be included as part of a team nomination.

3.1. Laboratory technology is defined as that work conducted under programs 6.1, 6.2,6.3, 6.4 and 6.5.

3.2. Technology Transfer and Customer. Transfer is defined as oral or written information or data, hardware, personnel, service facilities, equipment or other resources relating to scientific or technological developments, of an Air Force RDT&E activity, provided or disclosed by any means to another Federal agency, state or local government; an industrial organization or academic institution; to promote technological or industrial innovation for commercial or public purposes.

4. **Nomination.** Each AFMC center and AFRL directorate may submit one nomination each for the individual and team technology transfer award. One copy of the typed nomination and citation, and a 3 ½" diskette containing the nomination and citation are to be forwarded to AFRL/HR by 31 July of each year. The following information should be included in the nomination:

4.1. Name, occupational series or Air Force Specialty Code, grade or rank, organizational title, and office symbol of each nominee or all members of the team being nominated. Reference nomination format at Atch 1.

4.2. Justification of the nomination. Justifications are strictly limited to technologies that have been transferred. Justifications should follow the guidelines set forth in Atch 2, specifically these major areas: (A) Practical Commercial or Public Advancement Made by the Efforts of the Nominee(s); (B) Technology Transfer Effort by the Nominee(s) Beyond Normal Job Scope; and, (C) The Degree and Significance of Tangible Benefits to Industry or State/Local Government. Justifications are limited to two typed pages (single side only); type to be no smaller than 10 pitch Times New Roman; and, margins of one inch top, bottom and both sides.

4.3 Follow the example in Atch 3 for the Citation. For the team award, use the name on the citation.

4.4 Classified justifications are highly discouraged.

5. Selection.

5.1. The AFRL Commander (AFRL/CC) chairs the selection panel. Panel membership consists of the AFRL Executive Director (AFRL/CD), the AFRL Chief Scientist (AFRL/CA) and the Director of Plans and Programs (AFRL/XP).

5.2. The panel will select the individual and team nominees whose efforts best reflect excellence in technology transfer as defined in the guidelines found in Atch 2.

6. Announcement and Presentation.

6.1. The AFRL Commander will notify the individual or team selected by the panel.

6.2. The award will be presented at a time when the AFRL Commander and the recipient(s) are available, place and time TBD.

General Yates Technology Transfer Award Format and Scoring Guidelines

Submit award nomination packages using the following format:

Nomination for Gen. Ronald Yates Technology Transfer Award

Nominee:

Occupation Series/AFSC:

Grade:

Title:

Office Symbol:

Identified in each of the scoring categories are specific questions to assist in writing the nomination package.

INSTRUCTIONS: Scoring will be done by evaluating descriptions provided in the criteria subcategories as listed below. Not all subcategories may apply to every nomination. Highest possible score is 100 points. Criteria A is assigned up to 30 point; criteria B and C are assigned up to 35 points each. Total point scoring will be used for ranking.

A. Practical Commercial or Public Advancement Made by the Efforts of the Nominee(s)

1. **Description of Technology.** What technology was transferred? Briefly describe features, benefits, limitations.
2. **Tech Transfer Recipient and Need for Technology.** Who or what was the recipient of the transferred technology? Why was the technology needed? What problem was solved by the technology/technical advance?
3. **Technology or Technical Expertise.** What was the nominee(s)' involvement in the technology's development or availability?
4. **Initiation of Technology.** Who initiated the work for the technology/technical advance? Why was a federal lab the best place to achieve this work?

B. The Technology Transfer Effort by the Nominee(s) Beyond Normal Job Scope

1. **Tech Transfer Partnership.** Who were the partners in the technology transfer process? How did this partnership come about? What were the overall goals, objectives, and expectations of each partner? How were these goals/objectives/ expectations determined? How well were they met?
2. **Tech Transfer Processes Used/Innovations.** What technology transfer processes (*e.g.,* CRADAs, patents, licensing) were used to transfer the technology? Were there any innovative uses of these processes? Describe any innovations or creativity demonstrated by the nominee(s) in transferring the technology.
3. **Constraints.** What were the major challenges/constraints in transferring the technology? How were these challenges overcome?

4. **Time Frame.** What was the time frame for the transfer? (What happened when?) As succinctly as possible, provide a short outline of the technology transfer process.
5. **Technology Transfer Efforts Above and Beyond the Call of Duty.** What aspects of technology transfer are within the regular job duties of the nominee(s)? How did the nominee(s)' efforts on this transfer go beyond the call of duty?
6. **Patents and Publications.** Were any patents involved in this technology transfer? If applicable, cite one or two patent numbers/titles. Were there any publications involving this technology? If applicable, cite up to four relevant references.

7. **Final Results.** What was the final result of the tech transfer effort—a commercial product, CRADA, positive change in community/public sector, spinoff company, license? What agreements are pending and/or final regarding this technology? What follow-up activities are taking place with the technology transfer partner(s)? (Follow-up activities might include continuing problem-solving efforts or further assistance with commercializing the technology or helping the community/public sector.)

C. The Degree and Significance of Tangible Benefits to Industry or State/Local Governments

1. **Recipients/Technology Users.** Who are the recipients/technology users who will benefit from the technology transfer effort? How will they benefit from the transfer? What is the approximate size of this group(s)?
2. **Tangible Benefits and Their Significance.** What are the tangible benefits of the transfer effort? What is the significance of these benefits—both in the present and in the future? Wherever possible, provide quantitative data. Concentrate on: creation of a new industry/development of new product, a better method for doing something, impact on the community/public sector, higher profit margins, cost savings, competitive edge, improved health/safety, environmental benefits, etc.
3. **New Relationships.** Describe any new relationships that opened up new interactions with the public or private sector.
4. **Leveraging.** Describe any additional applications that might be developed from the transferred technology in the future.

CITATION FORMAT

CITATION TO ACCOMPANY THE AWARD OF

THE GENERAL RONALD W. YATES AWARD FOR
EXCELLENCE IN TECHNOLOGY TRANSFER

TO

TECHNOLOGY TRANSFER TEAM (OR INDIVIDUAL'S NAME)

CITATION

Print the citation in landscape format. Left and right margins must be 1 ½ inches. Limit the citation to approximately 90 words, which properly describe the nominee's accomplishments or achievements.

2001 FLC AWARDS FOR EXCELLENCE IN TECHNOLOGY TRANSFER

SUBMISSION COVER SHEET (FORM 01-CS)

OFFICIAL NAME OF LABORATORY (maximum of two lines): Propulsion Directorate, Air Force Research Laboratory

If you are submitting more than one nomination from this laboratory for consideration in 2001, please indicate how many other nominations are being submitted: ____1__

DESCRIPTIVE TITLE OF NOMINATED TECHNOLOGY TRANSFER (10 words or less): In Situ Densification of Carbon-Carbon Composites

DESCRIPTIVE PARAGRAPH:

In the box below, write a **BRIEF** summary of the nomination that describes: the transferred technology, the technology transfer process used, and the benefits of the transfer effort. If this nomination is chosen as a winner, this paragraph will be used in the official awards publication. Please write this paragraph in non-technical terms for a layman audience. If your facility/laboratory has a Public Affairs Office, we suggest asking this office to draft this paragraph in order to ensure compatibility with other publications pertaining to this transfer and technology.

To meet the U.S. Defense Department's need for lower cost operation and faster delivery time of carbon-carbon components, the Air Force Office of Scientific Research and the Air Force Research Laboratory Propulsion Directorate have pursued a low-cost rapid processing route for the production of high quality carbon-carbon composite material. This novel processing route called In Situ Densification places matrix material between the carbon fibers and produces composite material in 5%-25% of the time and at 10%-50% the cost of current commercial processes. In addition to being more rapid and lower cost than commercial processes, the In Situ Process is able to produce carbon-carbon composites that are not possible to produce by any other technology. For Example, the In Situ process is able to place matrix material in a very thick carbon fiber performs and produce a composite with a uniform density in a very short period of time.

In addition to saving the Department of Defense tens of millions of dollars in the procurement of carbon-carbon aircraft brakes, rocket nozzles, exit cones, and nose-tips, this novel process not only has dual-use applications in the private sector, but also opens the door for applications that have not been cost effective in the past. Like military aircraft, all commercial aircraft brakes are made from carbon-carbon. Thus, significant cost-saving can be realized in this market sector as well. In addition, the lower cost opens up markets in other brake and clutch applications. Finally, it should be noted that this material has numerous other diverse applications in areas such as, thermal management, chemical processing, silicon wafer processing, as well as high temperature furnace elements and components. These commercial applications as well as other are being pursued.

The technology was conceived, developed, and scaled-up to pilot scale by the innovative and highly motivated researchers of the High Temperature Components Group, Propulsion Materials Applications Branch, Propulsion Directorate, Air Force Research Laboratory located at Edwards AFB. At the research bench scale, a CRADA was negotiated with a leading aircraft brake manufacturer to tailor the process for aircraft brakes. At the point of pilot-scale production, a researcher left government service and formed SMJ Carbon in June 1999**.** This spin-off company became the first and only source of in situ densified material in the world. Following the formation of SMJ Carbon, a CRADA was negotiated with them for further cooperative process improvement. At about this same time, the SBIR process was used to produce an oxidation protection for the in-situ processed material. Finally, an exclusive license to SMJ Carbon was recently negotiated and approved in order to commercialize the technology.

NOMINEE INFORMATION

Total number of nominees (persons) for this technology transfer: __8______

Instructions: Please list the names and titles of all nominees in the space below. Designate one nominee as the primary contact and provide address information for this person. If any nominee(s) has a different address than the primary contact, provide this address information as well. Also provide contact information for the three individuals listed at the bottom of the form.

Primary Contact Name (Air force): Dr. Wesley Hoffman

Title: Research Group Leader

Organization: AFRL/PRSM

Address: AFRL/PRSM, 10 E. Saturn Blvd.

City: Edwards AFB **State: CA** **Zip: 93524-7680**

Phone: 661-275-5768 **Fax: 661-275-5007** **E-mail: Wesley.hoffman@ple.af.mil**

Primary Contact Name (Partner): Dr. Steven Jones, 515 Via Portel Rd., Oceanside, CA, 92057

Nominees:

Dr. Steven Jones, Founder and President, SMJ Carbon

Dr. Kevin Chaffee, Research Physicist, AFRL/PRSM

Dr. Wesley Hoffman, Group Leader, AFRL/PRSM

Mr. Phillip Counts, Research Technician, AFRL/PRSM

Dr. Phillip Wapner, Research Scientist, ERC, Inc.

Mr. Thomas Duffey, Research Technician, ERC, Inc.

Ms. Marietta Fernandez, Research Chemist, AFRL/PRSM

Ms. Hong Phan, Research Chemist, AFRL/PRSM

	FLC Representative Making Nomination	Nominee(s)' Supervisor	Laboratory Director
Name:	Kristen Schario	Maj. Joseph Hamrick III	Col. Alan Janiszewski
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E-mail	Kristen.schario@wpafb.af.mil	joseph.hamrick@ple.af.mil	Alan.Janiszewski@wpafb.af.mil

2001 FLC AWARDS FOR EXCELLENCE IN TECHNOLOGY TRANSFER

SUBMISSION COVER SHEET (FORM 01-CS)

OFFICIAL NAME OF LABORATORY (maximum of two lines):
Propulsion Directorate, Air Force Research Laboratory,

If you are submitting more than one nomination from this laboratory for consideration in 2001, please indicate how many other nominations are being submitted: ___1___

DESCRIPTIVE TITLE OF NOMINATED TECHNOLOGY TRANSFER (10 words or less):
YBCO Coated Conductors: the Second Generation High Temperature Superconducting Wire

DESCRIPTIVE PARAGRAPH:

In the box below, write a **BRIEF** summary of the nomination that describes: the transferred technology, the technology transfer process used, and the benefits of the transfer effort. If this nomination is chosen as a winner, this paragraph will be used in the official awards publication. Please write this paragraph in non-technical terms for a layman audience. If your facility/laboratory has a Public Affairs Office, we suggest asking this office to draft this paragraph in order to ensure compatibility with other publications pertaining to this transfer and technology.

Currently the Air Force is placing significant emphasis on the development of directed energy weapons (DEW) for tactical and support operations. Large amounts of power are required, particularly for high power microwave weapons. Although this power can be provided by conventional means, it requires large and heavy generators that impede battlefield mobility and in particular make airborne operations impossible. High temperature superconducting (HTS) generators are significantly lighter (an order of magnitude) and more compact, thus enabling the DEW technology. Critical to the operation of an HTS superconducting generator are the rotor windings that require the development and manufacture of high temperature superconducting coated conductors that can carry high amounts of current.

The Superconductivity Group, Power Systems Branch, Power Division, Propulsion Directorate, Air Force Research Laboratory conducts research and has developed several technologies that enable the manufacture of the HTS coated conductors. A highlight of this research is the discovery of a previously unknown substrate grain boundary effect in HTS coated conductors. This effect has a strong influence on the critical current that the HTS film can carry. The Superconductivity Group has successfully transitioned this and many other AFRL developed HTS coated conductor technologies to industry by developing and nurturing collaborative efforts involving multiple industry partners.

Dr. Barnes initiated and led the development of a CRADA between Intermagnetics General Corporation (IGC), the Materials Laboratory, and the Propulsion directorate, and secured cost share funding from IGC. This resulted in the establishment of a new company, IGC SuperPower, LLC. This new company will use AFRL developed technology to further develop and manufacture HTS coated conductors. In June 2000, IGC SuperPower, LLC opened a new HTS Coated Conductor Manufacturing facility. Putting this partnership together, and creating a new commercial partner took over two years, and incredible persistence on the part of Dr. Barnes. His efforts were key to ensuring each partner remained actively involved and committed to this effort. Dr. Barnes also played a key role in creating a cooperative research partnership with the University of Wisconsin Applied Superconductivity Center and the AFRL Superconductivity Group. This partnership resulted in the discovery of a grain boundary effect that sets a standard for substrate grain alignment for production of the textured substrate used in HTS coated conductors by industry. Dr. Barnes also established a collaborative effort with Applied Thin Films and American Superconductor Corporation (ASC) to transfer coated conductor technology developed by AFRL and Applied Thin Films to American Superconductor Corporation.

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Received: Submission Number:

NOMINEE INFORMATION

Total number of nominees (persons) for this technology transfer: ____1____

Instructions: Please list the names and titles of all nominees in the space below. Designate one nominee as the primary contact and provide address information for this person. If any nominee(s) has a different address than the primary contact, provide this address information as well. Also provide contact information for the three individuals listed at the bottom of the form.

Primary Contact Name: Paul N. Barnes

Title: Research Physicist/Program Manager

Organization: AFRL/PRPS

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Phone: (937) 255-2923 **Fax:** (937) 656-4095 **E-mail:** paul.barnes@wpafb.af.mil

	FLC Representative Making Nomination	**Nominee(s)' Supervisor**	**Laboratory Director**
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